IMPLEMENTING A MANAGEMENT PROGRAM FOR *SCLEROTINIA SCLEROTIORUM* IN SNAP BEANS.

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Industry Cooperators: Roger Ward of Birds Eye Foods, Bruce Sentiff and Del Mar Farms snap bean producers in Western NY.

Abstract:

Given the right environmental conditions, white mold (*Sclerotinia sclerotiorum*) can potentially infect 100 percent of the snap bean acreage in New York State. A black seedlike structure called a sclerotia resides in the soil as the overwintering/survival structure for *Sclerotinia sclerotiorum*, the causal agent of white mold. Part of the reason why white mold is such a problem in Western New York is because aside from snap beans many other commercial crops are hosts for *Sclerotinia sclerotiorum,* including dry beans, cabbage, potatoes, tomatoes, peppers, lettuce, vine crops, alfalfa, and soybeans. The main objective of this study was to evaluate Contans WG as a biological tool to manage white mold in snap beans and compare it with the industry standard Ronilan in an on-farm situation. Trials were set up in Genesee and Orleans Counties where growers applied Contans WG using their typical cultural practices at planting to a portion of the field. Contans WG reduced sclerotia populations over the course of the experiment from 0.2 to 0.0 sclerotia per liter of soil at one location but had no effect at the other (possibly due to Dual antagonism). Contans WG did not reduce white mold infection on the foliage. Ronilan reduced foliar incidence of white mold by 50 and 71%. The poorer control with Ronilan may be explained by the use of a low spray volume and poor penetration into the center of the canopy. Contans WG may reduce sclerotia populations in soil, but should not be used as a stand alone material for control of white mold.

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Introduction:

Given the right environmental conditions, white mold (*Sclerotinia sclerotiorum*) can potentially infect 100 percent of the snap bean acreage in New York State. A black seedlike structure called a sclerotia resides in the soil as the overwintering/survival structure for *Sclerotinia sclerotiorum*, the causal agent of white mold. Part of the reason why white mold is such a problem in Western New York is because aside from snap beans many other commercial crops are hosts for *Sclerotinia sclerotiorum,* including dry beans, cabbage, potatoes, tomatoes, peppers, lettuce, vine crops, alfalfa, and soybeans. If the soil conditions in a sclerotia-infected field are wet for approximately one to two weeks, the sclerotia can germinate to produce mushroom like structures, which eject spores. These are the spores that initially infect the crop plant (i.e. bean blossoms in a snap bean field). Disease development and spread is favored by moist conditions (i.e. rain or irrigation). In New York, common IPM management for control of white mold is through one and sometimes two foliar fungicide applications of Ronilan DF (*vinclozolin*) commencing at the flowering stage. Unfortunately, Ronilan is scheduled for deregistration in 2005. Alternatives to fungicide applications for white mold are considered a high research priority by the New York processing industry.

Contans WG (Encore Technology), containing the active ingredient *Coniothyrium minitans* (strain CON/M/91-08) is labeled in NY for the reduction/control of *Sclerotinia sclerotiorum* and *Sclerotinia minor*, causal organisms of white mold, pink rot and water soft rot, in agricultural soils. It is a naturally occurring, nonpathogenic, mycoparasitic soil fungi, which parasitizes the sclerotia of these diseases, thereby reducing the initial inoculum in the soil, which will ideally reduce disease incidence and severity. The optimum temperature range for its germination and growth is 77-86°F. Contans WG is applied on soils as a pre-plant treatment, ideally three to four months prior to on-set of disease, or as a post-harvest treatment. Contans WG is compatible with selected herbicides and can be tank mixed with Eptam and Treflan, but is not compatible and should not be tank mixed with Dual. According to Encore Technologies, Contans WG can be applied at the same time as Dual but not in the same tank mix.

Contans WG has looked promising in laboratory and small plot trials in Wisconsin and New York (Dillard *et al.*), but needs to be evaluated in commercial snap bean production before growers invest in this control tactic for white mold.

Objectives:

1) To examine the performance of Contans WG against an industry standard, Ronilan DF (vinclozolin) for white mold control under the commercial growing conditions in western New York.
2) To measure the ability of Contans WG to reduce the number of viable sclerotia in soil.

3) To educate snap bean growers and the broader industry about the use of Contans as a biological tool to manage white mold in snap beans.

Methods and Procedures:

Two field sites (Indian Falls Rd in Genesee Co. and Mill Rd in Orleans Co.) were selected according history of white mold problems, history of growing crops that are susceptible to white mold, availability of irrigation, and white mold sclerotia found in the soil. Soil samples were collected after spring plowing and first cultivation or disking. Each field was divided into a Contans WG treated area and an untreated area. Each grower applied Contans WG during tillage just prior to planting (Table 1). Dual was applied in a separate tank mix at the Genesee location while no Dual was applied at the Orleans location. Ideally, Contans WG should be applied 90 days prior to when the crop is susceptible to white mold damage, but this was not practical for these growers given the wet spring and tight planting schedules.

Table 1: Contans WG Application at 2 Locations in Western NY

Location	Indian Fall Road – Genesee	Mill Road – Orleans
Contans WG Application	3 lbs./acre @ 20 gal water Tank mixed 4 pts. Eptam and 1 pt. Treflan Dual applied ahead of packer	2.5 lbs./acre @19 gal water Tank mixed 3.5 pts. Eptam and 1 pt. Treflan No Dual applied
Application Equipment	Vibra Shank Cultivator –nozzles mounted at front	Tandem Disc – nozzles mounted at front
Nozzles	Nozzles: T-Jet XR8004	T-Jet Flat Fan 8005
Planting Date	Hystyle – 7/17/03	Hystyle - 7/23/03
Harvest Date	9/1103	9/20/03

Each field was divided into a grid. At the Genesee location (a larger field), the quadrant size was 90-foot centers down the rows by 30 rows between centers. At the Orleans location, (a smaller planting) there were 12 rows between centers. The grid at each site had a total of 50 quadrants arranged in a 5 x 10 design. The center of each quadrant was marked with a flag and GPS coordinates were taken. The Contans WG and Ronilan-treated areas consisted of 2 x 10 (=20) quadrants while the untreated control was 1 x 10 quadrants. A 1 liter soil sample was collected from the center of each quadrant at a 0 to 4-inch depth on August 21 at both sites (approx. 1 month after planting). Samples were then sent to the Dillard lab for analysis where they were wet sieved through stacked #10 and #20 soil screens to separate debris and sclerotia. Sclerotia were identified from the debris using a binocular microscope and then counted. This was a very labor-intensive process.

Fields were scouted throughout the growing season to evaluate the need for a foliar fungicide treatment (Table 2). At the Genesee location, it was decided to apply fungicide to the entire field. Sheets of plastic were placed just prior to commercially applying the fungicide and removed immediately after application to the untreated and Contans WG-only plots. An area of 3 rows x 6 foot of row was covered at the center in each quadrant of these areas. At the Orleans location, fungicide was applied to 6 rows at a time with drop nozzles (Table 2). Here the grower turned off his sprayer when he passed over the test areas.

Table 2: Foliar Applications at two locations in Western NY		
Location	Genesee	Orleans
Date	8/26/03	9/4/03
Foliar	1 lb. Orthene 97 & 1 lb. Ronilan DF	1 lb. Orthene 97 & 1 lb. Ronilan DF

Application	applied 20 gal water	applied 60 gal water
Nozzles	Full cone FL-10VS	Air induction AI1106VS & dual flat fan on drops TJ/60 1106VS

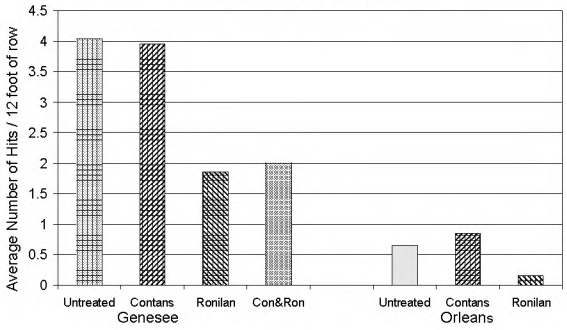
Visual ratings for white mold and other molds were taken one day prior to harvest. All plants were assessed in a 30 square foot area (3 rows X 4 foot long) near the center of each quadrant on September 10th (Genesee) and September 19th (Orleans). To evaluate the combination of Contans WG and a fungicide, plants were evaluated 3 feet from where the plastic was initially laid. Unidentifiable infections were taken to the Dillard lab for white mold (or other disease) confirmation. These samples were cultured on petri dishes containing potato dextrose agar with antibiotics, corn meal agar, and suspending tissue in sterile distilled water. After harvest, 1 liter soil samples were again taken from the center of each quadrant on September 22 at both sites. These were sent to Dillard's lab for sclerotia counts.

Results:

Foliar Evaluation

White mold occurred at both locations with higher pressure at the earlier planted Genesee location. Here, the average white mold incidence was 90, 85, 80, and 70% in the untreated control, Contans WG, Ronilan DF and Ronilan DF + Contans WG test areas, respectively. At the Orleans location, white mold pressure was much lower with 20, 50, and 15 % incidence in the untreated control, Contans WG, and Ronilan DF test areas, respectively.

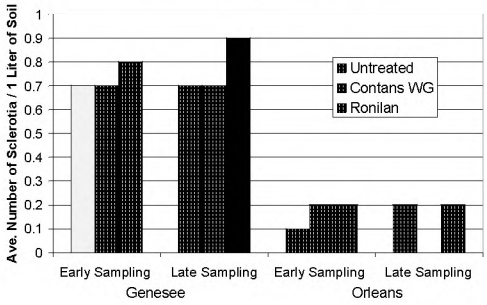
Figure 1: Average Number of White Mold Hits on Pods in Sample Areas



At the Genesee location, incidence of white mold was highest in the untreated control with an average of 4 hits per 12 foot of row, which was similar to the Contans WG treatment (3.95 hits/12 foot row) (Figure 1). Ronilan DF reduced white mold incidence by 54 % to 1.8 hits/12 foot row. Contans WG + Ronilan DF reduced incidence by 50 % to 2 hits/12 foot row. At this location, the white mold occurred primarily at the center of the plant canopy close to the stem and plant branches. This may suggest that good coverage was not achieved with the 20-gal/acre application of fungicide. At the Orleans location, white mold incidence was lower with 0.7-hits/12 foot row in the untreated control. Contans WG was slightly higher at 0.9 hits/12 foot row and Ronilan had almost 100 percent control with 0.2/12 foot row. Excellent coverage was achieved using higher volume (60 gal/acre) and drop nozzles to penetrate the canopy from the top and sides.

Botrytis gray mold (*Botrytis cinerea)* was also found at both locations, but at very low incidence. Contans WG does not control Botrytis gray mold. No foliar incidence of *Pythium, Fusarium* and *Rhizoctonia* from splashed soil was found in evaluated areas but was common in earlier plantings throughout western NY.

Figure 2: Sclerotia Counts in 1 Liter of Soil in Genessee and Orleans in 2003



Soil Sample Evaluation

Five random 1 liter soil samples were taken just after planting on July 21 (Genesee) and July 24 (Orleans), which had 0.67 sclerotia/L soil in the untreated sections at both

locations, and 1.25 and 1.0 sclerotis/L soil at Genesee and Orleans, respectively. At the August 21 sampling (more intensive: 50 samples per site), there were 0.7-0.9 and 0.1-0.2 sclerotia/L soil per treatment at Genesee and Orleans, respectively. This was surprising since the Genesee site had been rotated out of white mold susceptible crops for at least 4 years. Alternatively, the Orleans site had been continuous beans with a fall rye cover crop for the same time period. At Genesee, sclerotia counts in the untreated control and Contans WG areas of the field were unchanged from August to harvest, while they increased 0.1 sclerotia/L soil in the Ronilan treatment. At Orleans, there was a 71 % reduction of sclerotia in the soil from the August sampling to the harvest sampling where Contans WG was applied. Where Contans WG was not applied in the untreated control and Ronilan DF sections, sclerotia counts increased or remained the same. These results suggest that Contans WG may decrease soil populations of sclerotia.

Discussion and Conclusions:

Although there were differences in soil populations of sclerotia between the two locations, both sites had populations below 1 sclerotia/L soil, which makes firm conclusions difficult. It is important to note, however, that sclerotia can persist in soil for several years without a white mold outbreak as was demonstrated at the Genesee site. Also, there does not necessarily have to be a high level of sclerotia in the soil to incite significant disease also demonstrated at the Genesee site.

Contans WG appeared to reduce the number of sclerotia at the Orleans site, but not at the Genesee site. Dillard *et al.* (2002) reported reductions in soil sclerotia in small plot trials. Also, in 2002, we found that Contans WG decreased sclerotia counts by 43% 0.3 to 0.17 sclerotia/L soil over the season. Perhaps, Contans WG did not appear to work at the Genesee site due to an antagonistic effect of Dual. Even though Dual was not tank mixed with Contans WG, it was applied at the same time. This may be a problem for growers who do not want to make a separate pass just to apply Dual. Ideally, intensive soil sampling for sclerotia should have occurred close to the Contans WG application. Although, the results that we have from our initial quick sampling show higher initial levels of sclerotia, it is not enough to draw any conclusions from.

In this study, we had New York growers apply Contans WG in their most likely scenario, which was at planting. For best results, it is recommended that Contans WG be applied 90 days ahead of when the crop will be most susceptible to white mold. However, in New York conditions, this is not really feasible. Had Contans WG had more time to work under favorable conditions, it may have shown more of a reduction in soil sclerotia. More importantly, even where Contans WG appeared to reduce sclerotia counts in the soil, it did not reduce incidence of white mold in the foliage at either location. Contans WG does not provide any plant protection from air born spores.

For foliar fungicide control of white mold, coverage is critical as was demonstrated by the Orleans grower who used 60 gal/ac and drop nozzles who got almost 100% control compared to the Genesee grower who used 20 gal/ac and got only 50% control. A minimum of 50-gal/acre volume of water is needed to penetrate the canopy and get good coverage with fungicides.

Our research has shown that Contans WG may decrease soil populations of sclerotia which may translate into improved disease control. However, results to date have shown that Contans WG is not effective enough to provide reliable disease control without fungicides, if weather conditions are conductive to disease. Before applying any disease management strategy, be sure you have accurately diagnosed the disease ("true" white mold not just white fuzzy mold) since control methods differ for various pathogens.

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